PATENT
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REMARKS

Minor changes have been made to the specification. Claims 13, 14 and 15 are amended and claims 1-20 remain in the application.

Entry of this amendment to the specification and claims prior to Examination is courteously solicited.

No new matter is added by the amendments herein.

Respectfully submitted,

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MARKED UP COPY OF AMENDMENT PURSUANT TO 37 CFR § 1.121 (b)(1)(iii)

Page 1, line 5 to page 1, line 9.

BACKGROUND [OF THE INVENTION]

[Field of the Invention]

This patent application relates to calculating and reducing electromagnetic radiation at varying distances from computer and data processing systems.

[Description of the Related Art]

Page 2, line 10 to page 3, line 6.

Accordingly, efforts are made within the industry to limit the EMI generated by a system. But limiting generated EMI requires an estimate of the radiation for a specific system configuration. After the radiation level is known, reconfiguring the system may reduce the amount of EMI. A method is needed to predict radiation generated by a particular system at a fixed distance from the system. The present [invention] disclosure addresses this need.

SUMMARY [OF THE INVENTION]

The [invention] disclosure relates to a method for calculating radiation ("noise") emitted by a computer system. The [invention] disclosure relates to a method for calculating electromagnetic radiation. The method models the characteristic radiation from a central processing unit as a modulated Gaussian pulse. The method solves Maxwell's equation using finite differences in the time

domain. After solving Maxwell's equation the method determines if the radiation emitted by the heat sink is capacitively coupled to the radiation emitted by the remaining components of the computer system. The method also determines whether radiation emitted by the heat sink is inductively coupled to the radiation emitted by the remaining components of the computer system. Finally, the method uses a fast Fourier transform to translate time domain data to the frequency domain. The method also teaches using a computer system, with instructions coded on a computer readable medium to make the calculations described.

BRIEF DESCRIPTION OF THE DRAWINGS

The present [invention] disclosure may be better understood, and it's numerous objects, features, and advantages made apparent to those skilled in the art by referencing the accompanying drawings.

Page 3, line 14 to page 3, line 15.

Fig. 4 is a line diagram of a typical computer system for which the electromagnetic radiation can be calculated by the present [invention] disclosure.

Page 3, line 18 to page 3, line 21.

DETAILED DESCRIPTION

The following sets forth a detailed description of a mode for carrying out the [invention] disclosure. The description is intended to be illustrative of the [invention] disclosure and should not be taken to be limiting.

Page 9, line 5 to page 9, line 23.

[AN EMBODIMENT OF THE INVENTION]

An embodiment of the [invention] disclosure omits steps 104, 106 and 109 from the process. Current EMI test methods specify EMI levels in the frequency domain only. As described above, the [invention] disclosure may be used to determine if capacitive and inductive coupling exists. After determining if capacitive and inductive coupling exists the present [invention] disclosure may be practiced but limited to the frequency domain. (Analysis in the time domain is omitted). As shown in Figure 1B, the process begins again with the same 2 sets of variables as shown previously in Figure 1A -1: cpu information, logical step 101 and heat sink fin geometry information, logical step 102.

As in Figure 1 before, the process continues to a fast Fourier transform (FFT) as represented by logical step 111. In this embodiment, fast Fourier transfers data only from the time domain to the frequency domain. In this embodiment, the time domain analysis is omitted. The analysis is completed in the frequency domain only. After solving the transforming data using the fast Fourier transform, logical step 111, the confirms that the electromagnetic interference is at an acceptable level, logical step 112. If the electromagnetic interference is at an acceptance level, the process stops, logical step 130.[ ]

Page 10, line 20 to page 10, line 29.

The present [invention] disclosure may be used to calculate the electromagnetic interference generated by a computer system as shown in Figure 4. Computer system 430 includes central processing unit (CPU) 432 connected by host bus 434 to various components including main memory 436, storage device

controller 438, network interface 440, audio and video controllers 442, and input/output devices 444 connected via input/output (I/O) controllers 446. Heat sink 464 is located adjacent to CPU 432 as shown. Those skilled in the art will appreciate that this system encompasses all types of computer systems including, for example, mainframes, minicomputers, workstations, servers, personal computers, Internet terminals, network appliances, notebooks, palm tops, personal digital assistants, and embedded systems.

Page 11, line 16 to page 11, line 21.

While particular embodiments of the present [invention] <u>disclosure</u> have been shown and described, it will be recognized to those skilled in the art that, based upon the teachings herein, further changes and modifications may be made without departing from this [invention] <u>disclosure</u> and its broader aspects, and thus, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this [invention] <u>disclosure</u>.

Page 16, line 6 to page 16, line 16.

The [invention] <u>disclosure</u> relates to a method for calculating electromagnetic radiation emitted by a computer system. The method models the characteristic radiation from a central processing unit as a modulated Gaussian pulse. The method solves Maxwell's equation using finite differences in the time domain. After solving Maxwell's equation the method determines if the radiation emitted by the heat sink is capacitively coupled to the radiation emitted by the remaining components of the computer system. The method also determines whether radiation emitted by the heat sink is inductively coupled to the radiation emitted by the remaining components of the computer system. Finally, the method uses a fast Fourier transform to translate time domain data to the frequency domain. The

method also teaches using a computer system, with instructions coded on a computer readable medium to make the calculations described.

MARKED UP COPY OF AMENDED CLAIMS 13 - 15 PURSUANT TO 37 CFR § 1.121 (c)(1)(ii)

1. A method for calculating electromagnetic radiation, comprising:
determining the distance of a central processing unit from a heat sink;
determining a number of fins and a number of bars of the heat sink;
modeling characteristic radiation from the central processing unit as a modulated Gaussian pulse; and
estimating the electromagnetic field produced by the central processing unit using finite differences in time domain (FDTD) to solve Maxwell's equation.

2. The method as recited in claim 1, further comprising:
determining if the capacitive coupling exists between the heat sink and the central processing unit.

3. The method as recited in claim 1, further comprising:
reducing radiation noise by reducing capacitive coupling between the heat sink and the central processing unit.

4. The method as recited in claim 1, further comprising:
determining if inductive coupling exists between the heat sink and the central processing unit.

5. The method as recited in claim 1, further comprising:
reducing radiation noise by reducing inductive coupling between the heat sink and the central processing unit.

6. A method of designing a computer system, comprising:
determining the distance of a central processing unit from a heat sink;
determining a number of dins and a number of bars of the heat sink;
modeling the characteristic radiation from the central processing unit as a modulated Gaussian pulse; and
estimating the electromagnetic fields produced by the central processing unit using finite differences in the time domain (FDTD) to solve Maxwell's equation.

7. The method as recited in claim 6, further comprising:
reducing radiation noise by reducing capacitive coupling between the heat sink and the central processing unit.

8. The method as recited in claim 6, further comprising:
reducing radiation noise by reducing inductive coupling between the heat sink and the central processing unit.

9. The method of claim 6, further comprising:
using a fast Fourier transform to translate time domain data to frequency domain.

10. A method of manufacturing a computer system, comprising:
determining the distance of a central processing unit from a heat sink;
determining a number of dins and a number of bars of the heat sink;
modeling characteristic radiation from the central processing unit as modulated Gaussian pulse;
estimating the electromagnetic field-produced by the central processing unit using finite differences in a time domain (FDTD) to solve Maxwell's equation;
reducing radiation noise by reducing capacitive coupling between the heat sink and the central processing unit; and
reducing radiation noise by reducing inductive coupling between the heat sink and the central processing unit.

11. The method as recited in claim 10, further comprising:
using a fast Fourier transform to translate time domain data to frequency domain.

12. A computer program product encoded in computer readable media, the computer program product comprising:
a first set of instructions, executable on a computer system, configured to read data determining the distance of a central processing unit from a heat sink;
a second set of instructions, executable on a computer system, configured to model characteristic radiation from a central processing unit as a modulated Gaussian pulse; and
a third set of instruction, executable on a computer system, configured to estimate electromagnetic fields produced by the central processing unit using finite differences in a time domain to solve Maxwell's equation.

13. (Amended) The [method] <u>computer program product</u> as recited in claim 12, further comprising:

a fourth set of instructions, executable on a computer system, configured to determine if capacitive coupling exists between the heat sink and the central processing unit.

14. (Amended) The [method] <u>computer program product</u> as recited in claim 13, further comprising:

a fifth set of instructions, executable on a computer system, configured to determine if inductive coupling exists between the heat sink and the central processing unit.

15. (Amended) The [method] <u>computer program product</u> as recited in claim 14, further comprising:

using a fast Fourier transform to translate time domain data to frequency domain.

16. A computer system, comprising:

a central processing unit,

a heat sink coupled to the central processing unit, the heat sink having fins and bars, the number and fins and the number of bars of the heat sink determined by:

determining the distance of a central processing unit from a heat sink;

determining a number of fins and a number of bars of the heat sink;

modeling characteristic radiation from the central processing unit as a modulated Gaussian pulse; and

estimating the electromagnetic field-produced by the central processing unit using finite differences in a time domain to solve Maxwell's equation.

17. A computer system as recited in claim 16, further comprising:

reducing radiation noise by reducing capacitive coupling between the heat sink and the central processing unit.

18. A computer system, comprising:
a central processing unit;
a heat sink coupled to the central processing unit, the heat sink having fins and bars, the number nad fins and the number of bars of the heat sink determined by:
determining the distance of a central processing unit from a heat sink;
determining a number of dins and a number of bars of the heat sink;
modeling characteristic radiation from the central processing unit as modulated Gaussian pulse;
estimating the electromagnetic field-produced by the central processing unit using finite differences in a time domain to solve Maxwell's equation; and
reducing radiation noise by reducing inductive coupling between the heat sink and the central processing unit.

19. A computer system as recited in claim 18, further comprising:
using a fast Fourier transform to translate time domain data to frequency domain.

20. A heat sink for a computer system, the heat sink coupled to a central processing unit, the heat sink having fins and bars, the number of fins and the number of bars of the heat sink determined by:
determining the distance of a central processing unit from a heat sink;
determining a number of fins and a number of bars of the heat sink;
modeling characteristic radiation from the central processing unit as modulated Gaussian pulse; and
estimating the electromagnetic field-produced by the central processing unit using finite differences in a time domain to solve Maxwell's equation.